

## **REMARKS**

This paper is being provided in response to the Final Office Action mailed September 10, 2003, for the above-referenced application. Applicants submit herewith a Declaration by Alexander Rabinovich under 37 C.F.R. 1.132. Applicants respectfully submit the following remarks and request reconsideration.

The rejection of claims 1, 8-10, 18, 19, 25, 26, 28 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,409,784 to Bromberg et al. (hereinafter "Bromberg") and the rejection of claims 24 and 29 under 35 U.S.C. 103(a) as being unpatentable over Bromberg are hereby traversed and reconsideration is respectfully requested.

Independent claim 1 recites a plasmatron-catalyst apparatus for generating hydrogen rich gas. The apparatus includes a plasmatron and at least one catalyst for receiving an output from the plasmatron to produce hydrogen-rich gas. The catalyst is located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron. Claims 2-24 depend on independent claim 1.

Independent claim 25 recites a plasmatron-catalyst apparatus for generating hydrogen rich gas. The apparatus includes a plasmatron and a catalytic converter including at least one catalyst for receiving an output from the plasmatron to produce hydrogen-rich gas. The catalyst is located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron. Claims 26-29 depend on independent claim 25.

Independent claim 30 recites a plasmatron-catalyst apparatus for generating hydrogen rich gas. The apparatus includes a plasmatron and at least one catalyst for receiving an output from the plasmatron to produce hydrogen-rich gas. The catalyst is located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron. The catalyst is positioned within 1 to 10 cm downstream from the plasmatron.

The Bromberg reference recites a plasmatron-fuel cell system for generating electricity. The Office Action cites specifically the hydrogen separator membrane disclosed in Bromberg as teaching a catalyst positioned downstream from a plasmatron. The hydrogen separator membrane separates hydrogen output from carbon containing species such as carbon monoxide and carbon dioxide. (See col. 9, lines 19-25 of Bromberg.) No distances for positioning a hydrogen separator membrane downstream from a plasmatron are taught by Bromberg.

Applicants submit herewith a Declaration by Alexander Rabinovich under 37 C.F.R. 1.132. Alexander Rabinovich is a co-inventor of the present application and is a co-inventor of the Bromberg patent. Mr. Rabinovich confirms that in a catalyst positioned closely downstream from a plasmatron, radicals produced in the plasma can travel to the location of the catalyst and activate the catalyst to generate active catalysis. The radicals have finite lifetimes on the order of 10 microseconds to 1 millisecond. For velocities of 10-100 m/s, the catalyst needs to be located within 1 cm to 10 cm downstream from the plasma source in order to effectively use the radicals that are generated. (See paragraph 4 of the Rabinovich Declaration.)

Further, Mr. Rabinovich states that in no experiments conducted prior to the filing of Bromberg patent was a hydrogen separator membrane, as referenced in col. 9, lines 19-26 of that reference, positioned so as to be activated by hydrogen and radicals produced by a plasmatron or, specifically, within 1 to 10 cm downstream from the plasmatron. He states that the hydrogen separator membrane was not employed as a catalyst and that positioning the hydrogen separator membrane in the manner as claimed by Applicants was not contemplated in developing the subject matter of that Bromberg patent. He notes that the desirability and beneficial effects of positioning a catalyst downstream from a plasmatron in the manner as claimed was not recognized until the conception of the present invention. (See paragraphs 6 and 7 of the Rabinovich Declaration.)

In view of the above, Applicants respectfully submit that Bromberg does not teach or fairly suggest at least the features of a plasmatron-catalyst system having a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron or, specifically, within 1 to 10 cm downstream from the plasmatron, as claimed by Applicants. Accordingly, Applicants respectfully request that these rejections be reconsidered and withdrawn.

The rejection of claims 2, 3, 4, 5, 6, 7, 15 and 30 under 35 U.S.C. 103(a) as being unpatentable over Bromberg in view of U.S. Patent No. 5,852,927 to Cohn et al. (hereinafter "Cohn") is hereby traversed and reconsideration is respectfully requested.

Claims 2, 3, 4, 5, 6, 7 and 15 depend from independent claim 1, the features of which are described above. Independent claim 30 is also discussed above.

The Cohn reference discloses an integrated plasmatron-turbine system and is cited by the Office Action as disclosing that plasmatrons of a conventional design have an air input stream.

Applicants respectfully submit that Cohn fails to overcome the above-noted deficiencies of Bromberg with respect to Applicant's independent claims. Cohn does not disclose a catalyst positioned as claimed by Applicants and does not address catalyst activation or specific downstream distances. Applicants submit that neither Cohn nor Bromberg, taken alone or in combination, teach or suggest a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron, or specifically, 1 – 10 cm downstream from the plasmatron, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 16 and 17 under 35 U.S.C. 103(a) as being unpatentable over Bromberg in view of Cohn and further in view of U.S. Patent No. 5,425,332 to Rabinovich et al. (hereinafter "Rabinovich") is hereby traversed and reconsideration is respectfully requested.

Claims 16 and 17 depend from independent claim 1, the features of which are described above.

The Rabinovich reference discloses an internal combustion engine connected to receive hydrogen-rich gas from a plasmatron and is cited by the Office Action as disclosing that waste water is recycled back to the plasmatron and that a diesel engine can be utilized with a plasmatron.

Applicants respectfully submit that Rabinovich fails to overcome the above noted deficiencies of Bromberg and Cohn with respect to Applicant's independent claims. Specifically, neither Bromberg, Cohn nor Rabinovich, taken alone or in any combination, teach or suggest a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 11, 12, 14 and 21 under 35 U.S.C. 103(a) as being unpatentable over Bromberg in view of U.S. Patent No. 6,245,303 to Bentley et al. (hereinafter "Bentley") and further in view of U.S. Patent No. 5,567,398 to Ruhl et al. (hereinafter "Ruhl") is hereby traversed and reconsideration is respectfully requested.

Claims 11, 12, 14 and 21 depend from independent claim 1, the features of which are described above.

The Bentley reference discloses a reactor for producing hydrogen from hydrocarbon fuels including a first zone, a second zone, a third zone, a fourth zone and a product gas collection space. The Office Action cites Bentley as disclosing the use of a partial oxidation process,

followed by steam reforming, and followed lastly by a shift reaction wherein each reaction uses a catalyst.

The Ruhl reference discloses a compact endothermic reaction apparatus and is cited by the Office Action as disclosing that excess water used in a water shift reaction will result in increased CO<sub>2</sub> and H<sub>2</sub> produced.

Applicants respectfully submit that Bentley and Ruhl fail to overcome the above noted deficiencies of Bromberg with respect to Applicant's independent claims. Specifically, neither Bromberg, Bentley nor Ruhl, taken alone or in any combination, teach or suggest a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 13 and 22 under 35 U.S.C. 103(a) as being unpatentable over Bromberg in view of Bentley and further in view of Ruhl and U.S. Patent No. 5,674,308 to Meissner et al. (hereinafter "Meissner") is hereby traversed and reconsideration is respectfully requested.

Claims 13 and 22 depend from independent claim 1, the features of which are described above.

The Meissner reference discloses a method and apparatus for producing direct reduced iron from iron oxide fines and is cited by the Office Action as disclosing that steam reforming requires excess water to prevent carbon deposition on a reforming catalyst.

Applicants respectfully submit that Bentley and Ruhl fail to overcome the above noted deficiencies of Bromberg with respect to Applicant's independent claims. Specifically, neither Bromberg, Bentley nor Ruhl, taken alone or in any combination, teach or suggest a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals produced by the plasmatron, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 23 and 27 under 35 U.S.C. 103(a) as being unpatentable over Bromberg in view of Rabinovich is hereby traversed and reconsideration is respectfully requested.

Claims 23 and 27 depend from independent claims 1 and 25, respectively, the features of which are described above.

Applicants respectfully submit that Rabinovich fail to overcome the above noted deficiencies of Bromberg with respect to Applicant's independent claims. Specifically, neither Bromberg nor Rabinovich taken alone or in any combination, teach or suggest a catalyst located at a position downstream from the plasmatron so as to be activated by hydrogen and radicals

produced by the plasmatron, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4792.

Respectfully submitted,  
CHOATE, HALL & STEWART

A handwritten signature in black ink, appearing to read 'E. Cocks', is written over a horizontal line.

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